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Chistyakov

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(54) **HIGH-DENSITY PLASMA SOURCE USING EXCITED ATOMS**

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(73) Assignee: **Zond, Inc.**, Mansfield, MA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

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(22) Filed: **May 12, 2003**

Related U.S. Application Data

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(51) **Int. Cl.**[7] **H01J 7/24**

(52) **U.S. Cl.** ..... **315/111.21**; 315/111.41; 156/345.44; 118/723 DC

(58) **Field of Search** ..... 315/111.21, 111.41, 315/111.61, 111.71, 111.81, 111.91; 204/298.07, 298.08, 298.121, 298.161, 298.2, 298.21, 298.22; 156/345.33, 345.35, 345.38, 345.39, 345.4, 345.41, 345.42, 345.43, 345.44, 345.46; 118/723 ME, 723 DC, 723 I, 723 IR

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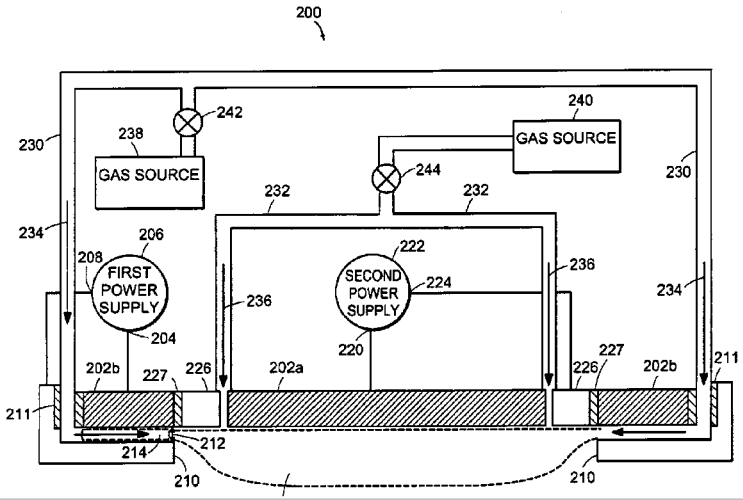
(57) **ABSTRACT**

The plasma source includes a cathode assembly. An anode is positioned adjacent to the cathode assembly. An excited atom source generates an initial plasma and excited atoms from a volume of feed gas. The initial plasma and excited atoms are located proximate to the cathode assembly. A power supply generates an electric field between the cathode assembly and the anode. The electric field super-ionizes the initial plasma so as to generate a high-density plasma.

35 Claims, 19 Drawing Sheets



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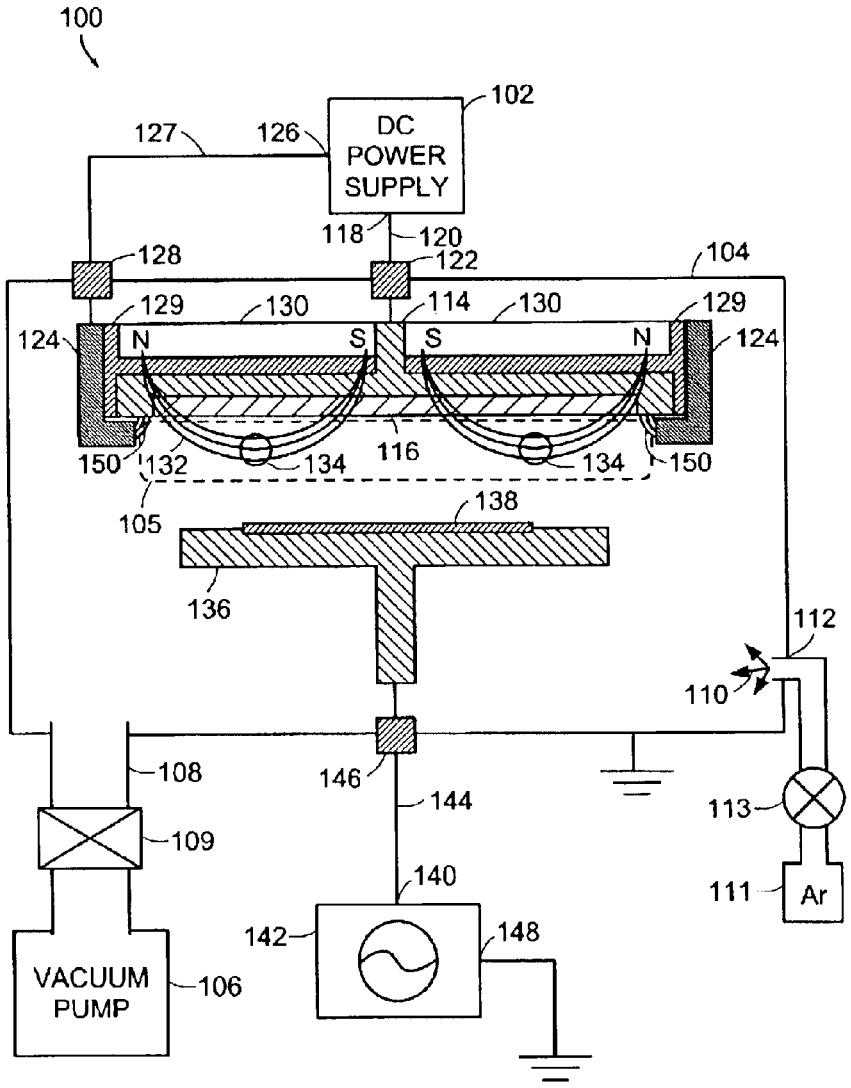

FIG. 1
PRIOR ART

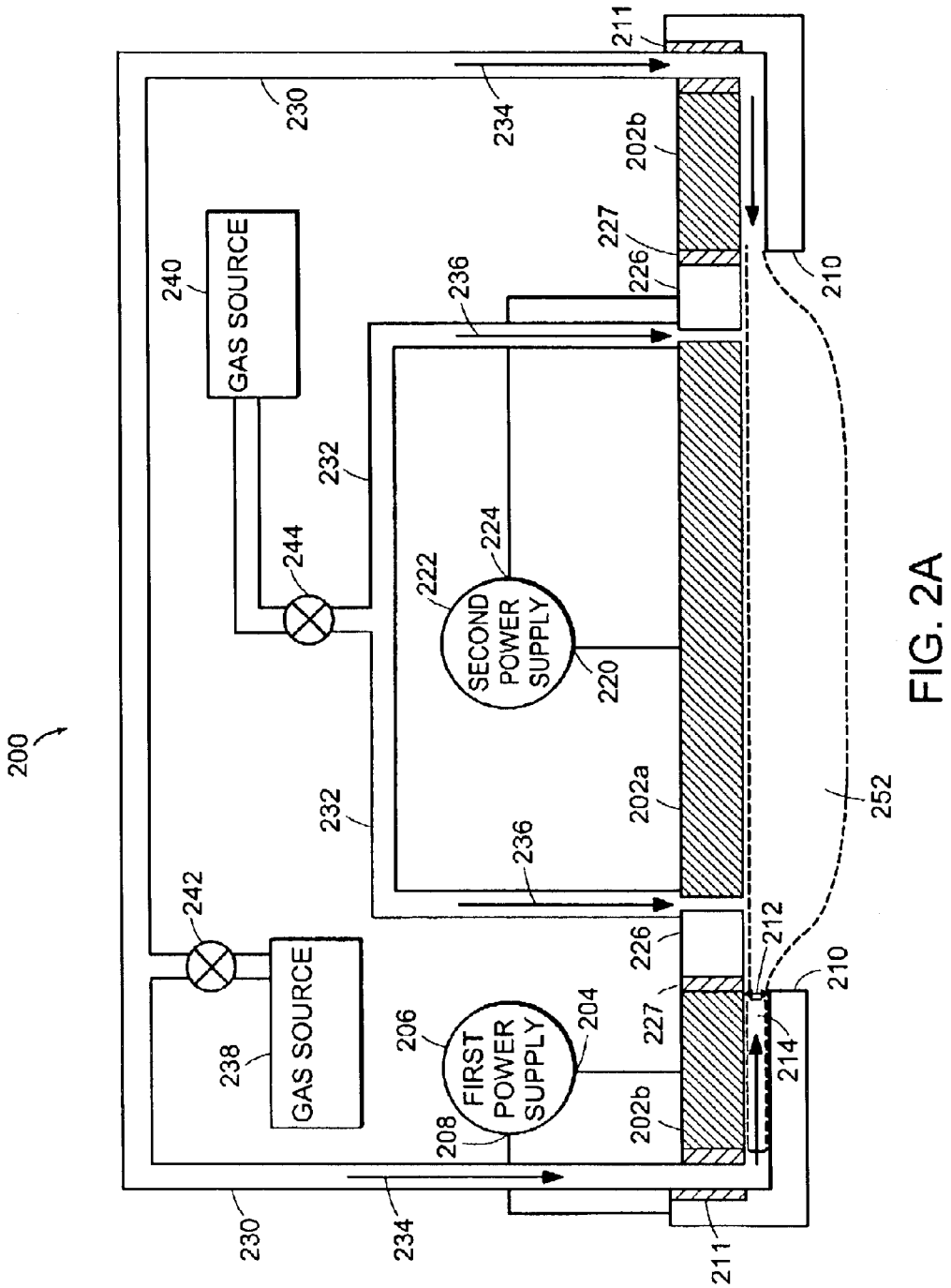

FIG. 2A

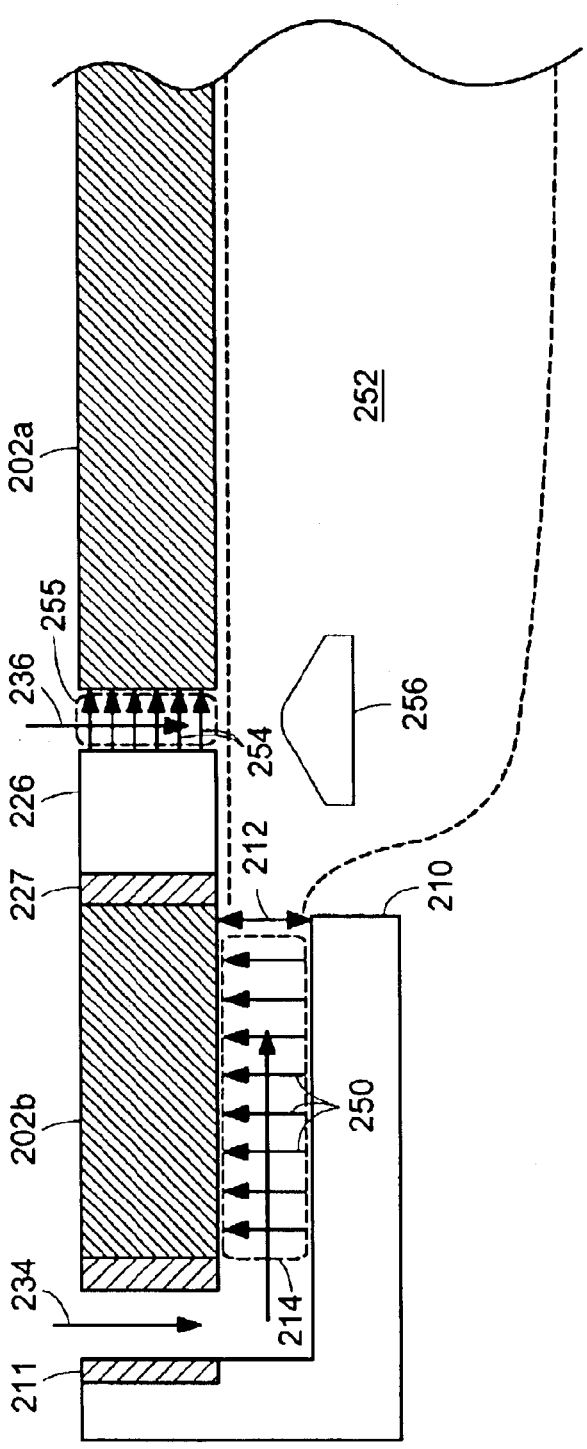

FIG. 2B

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